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Teratologic Effects of Long-Term Exposure to Diesel Exhaust Emissions (Rats)

WIL Research Labs., Inc.
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This research project was initiated with the objective of evaluating the potential for diesel exhaust emissions to produce malformations in rat fetuses. The dams were exposed by the inhalation route to a 10% concentration of diesel exhaust emissions in inhalation chambers on days 6 through 15 of gestation. Methods used conform to the guideline developed by the Food and Drug Administration for evaluating teratogenic effects in rats.

The results of the exposure of pregnant rats indicate that diesel exhaust emissions have no effect upon the normal development of rat fetuses.

Diesel exhaust emissions did not effect any of the parameters evaluated to assess maternal toxicity nor total number of fetuses born.

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by

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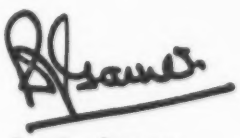
FOREWORD

The use of diesel engines for both personal and commercial transportation is increasing, and there is very little information presently available concerning the toxicology of whole emissions from diesel exhaust.

This study was performed by WIL Research Laboratories, Inc. to contribute information as to the potential teratogenic effects of diesel exhausts when rats were exposed to diesel exhaust emissions. The procedures utilized in exposure and fetal evaluations were developed by the Food and Drug Administration for evaluating teratogenic effects of new drugs.



R. J. Garner
Director
Health Effects Research Laboratory

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The results of the exposure of pregnant rats indicate that diesel exhaust emissions have no effect upon the normal development of rat fetuses.

Diesel exhaust emissions did not effect any of the parameters evaluated to assess maternal toxicity nor total number of fetuses born.

This report was submitted in fulfillment of Contract No. 68-03-2652 by WIL Research Laboratories, Inc. under the sponsorship of the U. S. Environmental Protection Agency. This contract includes the evaluation of the teratogenic effect of diesel exhaust emissions in rabbits and this work is continuing and will be reported separately from this report. This report covers the period September 15, 1978 to February 7, 1979 when the work was completed.

CONTENTS

Foreword iii
Abstract iv
Tables vi
Abbreviations vii

1 Introduction 1
2 Experimental Design 2
Test Material 2
Treatment Preparation and Administration 2
Animals - Requisition and Care 2
Dosage Selection 3
Mating Procedure 3
Treatment and Dosing Schedule 3
Observations During Gestation Period 3
Observations at Time of Laparotomy 3
Fetal Examination 4
3 Results 5
General Observations 5
Body Weights of Adult Male and Female Rats 5
Fertility - Mating Data 5
Laparotomy Data 12
Fetal Visceral Data 12
Fetal Skeletal Data 12
Gross Necropsies 13

TABLES

Number		Page
1	Individual Body Weights for Dams Which Were Exposed to Clean Air (Group 1)	6
2	Individual Body Weights for Dams Which Were Exposed to Diesel Exhaust Inhalation (Group 2)	7
3	Individual Weekly Body Weights for Male Rats Which Mated with Group 1 Females	8
4	Individual Weekly Body Weights for Male Rats Which Mated with Group 2 Females	9
5	Individual Mating Data	10
6	Gross Fetal Examination at Time of Laparotomy	14
7	Individual Fetal Data for Dams Which Were Exposed to Clean Air; Sex Distribution, Mean Body Weight, Individual Fetus Weight, Group Fetal Weight, Fetal Position in Uterine Horn	18
8	Individual Fetal Data for Dams Which Were Exposed to Diesel Exhaust Emissions; Sex Distribution, Mean Body Weight, Individual Fetus Weight, Group Fetal Weight, Fetal Position in Uterine Horn	19
9	Individual Fetal Data for Dams Which were Exposed to Clean Air; Number of Fetuses Viable and Dead, Early Resorptions, Implantation Sites and Corpora Lutea	20
10	Individual Fetal Data for Dams Which Were Exposed to Diesel Exhaust Emissions; Number of Fetuses Viable and Dead, Early Resorptions, Implantation Sites and Corpora Lutea	21
11	Soft Tissue Examination of the Fetuses	22
12	Skeletal Examination of Term Fetuses - Mean Number of Ossified Elements (Group 1)	23
13	Skeletal Examination of Term Fetuses - Mean Number of Ossified Elements (Group 2)	25
14	Skeletal Examination of the Fetuses	28
15	Gross Necropsy Results for 20-Day Laparotomy Female Rats	30

ABBREVIATIONS

P	=	Pregnant
NP	=	Not Pregnant
NN	=	Not Necessary
BB	=	Did Not Breed
C	=	Cesarean Section
S	=	Sacrificed
B	=	Bred
M	=	Male
F	=	Female
L	=	Left
R	=	Right

SECTION 1

INTRODUCTION

Diesel fuel has increased in the use of diesel engines in vehicular traffic and there is little information presently available concerning the toxicology of whole emissions from diesel exhaust, thus the proposal made in RFP No. C1 77-0221 was performed on laboratory pregnant animals to establish potential teratogenic effects during the period of fetal development.

The objective of this study was to evaluate the potential of diesel exhaust emissions to produce malformations and/or other teratogenic effects in the unborn fetus when dams were exposed by means of inhalation during the period of organogenesis. The methods described herein conform to the guideline developed by FDA in 1966[1].

Diesel exhaust emissions produced no malformations nor other teratogenic effects in the unborn rat fetus when dams were exposed to a 10% concentration of diesel exhaust by means of inhalation during the period of organogenesis.

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[1] Guidelines for Reproductive Studies for Safety Evaluation of Drugs for Human Use, January 1966, FDA.

SECTION 2

EXPERIMENTAL DESIGN

TEST MATERIAL

The test material used in this study was diesel exhaust emissions generated by a diesel engine located at the EPA Center Hill Laboratory, Cincinnati, Ohio. As a control, clean air was administered by the same means; at chambers also located at EPA Center Hill Laboratory. The first day of inhalation exposure was November 1, 1978.

TREATMENT PREPARATION AND ADMINISTRATION

A ratio of ten percent diesel exhaust emission to ninety percent clean air was administered to the test group (Group 2). Inhalation was the route of administration in chambers 4 1/2 feet square. The control group (Group 1) was also exposed in 4 1/2 feet square inhalation chambers with 100% clean air. The Center Hill EPA Laboratory was responsible for maintaining the proper exposure rates, monitoring procedures, and care of the laboratory animals during the exposure period.

ANIMALS - REQUISITION AND CARE

Forty female albino rats and twenty male albino rats, Sprague Dawley strain, ten weeks of age, were obtained from Charles River Breeding Labs, Portage, Michigan. The rats were received on September 15, 1978.

The animal care procedures for the female rats were the responsibility of WIL Research Laboratories, Inc., during the quarantine period and Days 0 through 5, and 16 through 20 of gestation. The EPA Center Hill Laboratory, Cincinnati, Ohio, was responsible for the animal care of the female animals during the exposure period which was Day 6 through 15 of gestation.

The animal care for the male rats was the responsibility of WIL Research Laboratories, Inc., for the entire duration of the study. All animal care procedures used in the performance of this study adhered to the principles defined in the Guide for Laboratory Animal Facilities and Care and The Animal Welfare Act and Amendments.

All animals at WIL were kept in a conventional room in AALAC approved cages during the quarantine and the nonexposure periods. Purina Laboratory Chow and fresh tap water were available ad libitum during the quarantine period and the nonexposure periods.

All rats were examined prior to selection for this study and only those animals determined to be in good health were selected for testing. During the quarantine period the animals were permanently identified by the ear-punch method.

Following the exposure time in the chambers at the EPA facilities, the rats remained in individual cages at which time clean air was administered. The animals were maintained in the individual cages within the chamber rooms which used a 12-hour light cycle during the animals' daily routines. The inhalation chamber was thoroughly sanitized between each exposure period to minimize the possibility of disease transmission. At this time, individual cages were placed outside the chambers and then replaced after cleaning.

DOSAGE SELECTION

The EPA conducted preliminary studies to determine the 10% concentration of diesel exhaust emissions in the exposure chambers. The Environmental Protection Agency personnel were responsible for assuring chamber concentrations and exposure time.

MATING PROCEDURE

The female animals were randomly selected and placed in either the test group or control group. Each of the twenty male rats was mated to two females. The first of the two females was housed with the male until a copulatory plug was observed. After evidence of copulation, the second female was housed with the male and observed for a copulatory plug.

If a plug, or other evidence of copulation, was not observed in a female after 14 days of mating, the female was mated with another male. The day a copulatory plug was observed was considered to be Day 0 of gestation.

TREATMENT AND DOSING SCHEDULE

The female rats were exposed on Days 6 through 15 of gestation for 8 hours per day. Group 1 was exposed to 100% clean air while Group 2 was exposed to the 10% diesel exhaust emissions and 90% clean air.

OBSERVATIONS DURING GESTATION PERIOD

All female rats were examined daily for signs of toxicity, general health and behavior. Each dam was weighed on Days 0, 6 through 15, and 20 of gestation.

One female in the control group (1207-17) was inadvertently killed on Day 18 of her pregnancy due to technician's error as she thought the rat had not been successfully bred. The rat was not exposed to the clean air.

All males were observed daily from the initiation of mating until the cesarean sections were completed, then they were killed.

OBSERVATIONS AT TIME OF LAPAROTOMY

The female rats were terminated on Day 20 of gestation with an intracardial dose of sodium pentobarbital. A cesarean section and a gross necropsy of each female was performed. The following observations were made:

1. Total number of fetuses.
2. Total number of live and dead fetuses.
3. Number of resorbed or resorbing fetuses.

4. Number of implant sites.
5. Number of corpora lutea.
6. Distribution of fetuses within the uterine horns.
7. Any remarkable gross pathology in the dam.
8. Examination of the fetuses as removed from the uterus:
    a. External conformation and anomalies.
    b. Individual body weight of each fetus and total litter weight.
    c. Sex of each fetus.

The last cesarean section was performed on December 6, 1978.

FETAL EXAMINATION

Each fetus was examined by a teratologist for external anomalies of the head, mouth, dorsal, and ventral aspects of the body, limbs, and tail. One-third of the fetuses were placed in Bouin's fixative and examined for gross internal anomalies by careful Wilson Sectioning[2]. The remaining two-thirds of the fetuses were placed in 95% ethyl alcohol and examined for skeletal anomalies following preparation of the skeletons by the Alizarin Red S Procedure[3]. Fetal examinations were completed on February 7, 1979.

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[2]"Environment and Birth Defects," James G. Wilson, Children's Hospital Research Foundation, University of Cincinnati College of Medicine, 1973.

[3]"Pathology and Toxicology, Technique Manual," edited by L. Z. Saunders; Research and Development Division, Smith, Kline and French Laboratories, Philadelphia, Pennsylvania, 1969, pages 1-13.

SECTION 3

RESULTS

GENERAL OBSERVATIONS

Female rats were not observed to have any change in behavior nor signs of toxicity during the study. Dried red material was observed around the nose of one control rat on Day 15 and at the perimeter of the eyes of one rat on Days 18 through 21 of the study.

Six rats exposed to diesel exhaust were observed to be hyperactive during the first week of exposure and head swaying was observed in four rats on one day of the exposure period. The reason for these observations is not clearly understood, but probably is due to irritation of the mucous membranes caused by the exhaust emissions. There was black particulate matter on the chamber, cages and rats in the diesel exhaust chambers on the days when these signs were observed and possibly contributed to irritation. The male rats were not exposed to the diesel exhaust emissions and remained within the limits of normal during the study.

BODY WEIGHTS OF ADULT MALE AND FEMALE RATS

Diesel exhaust emissions produced no reduction in body weight gains of females exposed during Days 6 through 15 following the observation of a copulatory plug. The three females found to be not pregnant actually lost weight during the study and the pregnant rats in both the control and exposure groups gained weight at a similar rate.

The male rats were not exposed to diesel exhaust but they were weighed during the time that the females were exposed and these animals gained weight at a normal rate (Tables 1, 2, 3 and 4).

FERTILITY - MATING DATA

Individual mating data for females in Groups 1 and 2 are presented in Table 5. The fertility index for the females for each group was calculated using the following formula:

$$\text{Fertility Index} = \frac{\text{No. Pregnant Females}}{\text{No. Females Mated}} \times 100$$

Group 1 females exposed to clean air had a conception rate of 89% (17 of 19 animals were pregnant), and the conception rate of females exposed to diesel exhaust was 95% (19 of 20 animals were pregnant) (Table 5).

TABLE 1

INDIVIDUAL BODY WEIGHTS FOR DAMS WHICH WERE
EXPOSED TO CLEAN AIR (GROUP I - CONTROL)

Rat Number	Day 0	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 20	% Body Weight Increase	P* NP**
1207-2	260.6	270.5	269.8	279.7	278.6	290.6	292.7	295.3	299.6	300.6	310.0	398.9	53	P
1207-3	274.6	286.2	291.8	290.7	294.5	291.4	293.6	304.5	303.9	302.0	300.2	304.8	11	NP
1207-5	255.3	271.6	274.2	269.8	268.6	280.2	281.1	290.1	297.4	299.4	306.5	349.3	37	P
1207-6	274.4	277.6	274.3	284.3	275.0	291.6	302.1	306.8	306.5	309.8	315.5	397.4	45	P
1207-8	325.0	334.0	336.0	345.1	346.5	351.6	359.8	369.9	368.0	368.0	375.4	473.1	46	P
1207-9	379.6	361.2	369.5	370.4	370.3	375.0	379.9	382.8	390.4	390.9	399.6	463.7	22	P
1207-11	308.0	297.8	309.4	302.7	311.2	315.8	324.4	329.2	336.8	343.3	355.2	417.5	36	P
1207-12	288.9	294.2	308.3	303.9	310.3	316.3	316.5	318.2	320.1	322.1	326.4	399.1	38	P
1207-14	292.2	281.3	300.1	300.5	307.7	316.3	319.7	326.6	332.7	337.5	348.2	423.4	45	P
1207-15	258.8	267.2	276.4	285.1	268.7	271.2	285.7	283.5	297.0	297.3	305.3	363.8	41	P
1207-17[1]	-	-	-	-	-	-	-	-	-	-	-	-	-	P
1207-18	308.5	309.1	317.8	316.9	314.5	319.4	330.0	332.9	345.2	345.1	353.1	434.3	41	P
1207-20	260.2	240.1	256.2	267.4	263.1	269.3	272.5	282.5	281.5	284.0	295.4	367.5	41	P
1207-21	288.5	310.9	314.7	319.8	322.0	336.3	340.0	350.1	350.6	353.6	358.9	435.5	51	P
1207-23	305.7	296.4	298.4	311.0	321.0	326.2	338.4	342.1	346.3	352.4	355.4	441.6	44	P
1207-24	276.1	285.2	296.8	300.5	308.7	310.4	310.1	316.7	323.4	324.9	333.1	387.3	40	P
1207-26	270.8	277.1	273.2	278.9	283.1	276.1	290.6	293.1	299.1	308.1	318.8	366.6	35	P
1207-27	283.9	267.3	277.5	280.2	271.9	266.9	270.7	291.6	287.2	283.7	280.3	278.2	-2	NP
1207-29	285.1	275.4	283.6	293.9	302.8	308.7	303.9	323.8	330.2	332.4	345.6	433.1	52	P
1207-30	283.4	284.7	286.5	286.3	291.8	295.8	301.7	306.6	315.1	308.8	319.9	369.6	30	P
Average	288.4	288.8	295.5	299.3	300.5	314.8	311.2	318.2	322.7	324.4	331.7	395.0	37.2	

* Pregnant

** Not Pregnant

1 Female was sacrificed due to miscalculation of pregnancy and non-exposure

TABLE 2

INDIVIDUAL BODY WEIGHTS FOR DAMS WHICH WERE
EXPOSED TO DIESEL EXHAUST INHALATION (GROUP II - TEST)

Rat Number	Day 0	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 20	% Body Weight Increase	P* NP**
1207-32	302.4	298.9	308.3	305.3	309.5	317.5	323.1	330.1	329.1	337.1	347.4	412.4	36	P
1207-33	252.3	266.1	269.8	279.0	280.4	270.0	254.3	280.7	289.4	291.3	294.8	371.0	47	P
1207-35	238.5	242.8	254.6	256.8	256.5	263.3	272.3	273.5	253.7	281.3	283.8	353.4	48	P
1207-36	303.1	334.1	329.2	337.3	339.3	347.1	351.5	351.7	360.2	364.0	376.6	455.5	50	P
1207-38	319.0	311.9	332.8	335.7	341.6	339.7	342.4	351.8	359.9	356.0	368.1	468.0	47	P
1207-39	308.8	317.4	325.2	324.3	327.4	326.2	336.5	336.7	345.6	345.0	358.4	440.8	43	P
1207-41	270.6	270.3	278.8	277.7	280.2	289.8	290.7	297.0	303.0	311.4	318.3	373.6	38	P
1207-42	280.2	292.1	286.4	293.0	300.8	306.8	310.6	316.5	324.6	327.6	338.9	417.0	49	P
1207-44	273.1	287.0	287.8	289.5	295.3	298.7	306.6	308.5	309.6	311.9	320.4	390.4	43	P
1207-45	299.6	308.1	309.4	306.6	311.8	324.8	326.5	336.1	333.8	345.2	361.1	425.4	42	P
1207-47	315.7	320.4	316.9	327.7	329.0	336.0	348.1	348.6	346.5	349.0	358.3	449.1	42	P
1207-48	284.3	293.2	296.5	300.8	295.8	316.2	305.0	319.6	316.3	320.5	335.4	397.6	40	P
1207-50	285.3	259.3	267.3	272.5	271.5	271.3	269.5	270.0	271.1	272.1	273.0	278.0	-3	NP
1207-51	330.9	341.2	344.4	349.8	350.8	358.7	368.1	365.2	370.9	370.2	379.5	442.7	34	P
1207-53	284.5	296.3	307.0	311.5	315.7	317.3	320.0	324.4	331.0	341.3	318.2	412.1	45	P
1207-54	303.7	317.5	317.6	318.4	325.6	324.5	331.9	329.4	338.6	345.1	356.1	465.5	53	P
1207-56	310.3	319.7	325.4	325.4	331.3	332.2	333.9	347.9	357.1	368.4	379.6	474.4	53	P
1207-57	281.1	298.0	300.4	303.6	305.4	308.9	314.7	315.9	328.6	324.7	336.5	420.6	50	P
1207-59	277.8	286.1	286.6	285.1	290.8	295.6	296.9	300.3	311.8	313.8	323.9	398.9	44	P
1207-60	314.6	330.3	330.1	332.1	332.3	341.9	329.9	348.4	349.3	350.6	365.6	442.1	41	P
Average	291.8	299.5	303.7	306.6	309.6	314.0	316.6	322.6	326.5	331.3	339.7	414.4	42	

* Pregnant
** Not Pregnant

TABLE 3
WEEKLY BODY WEIGHTS FOR MALE RATS WHO MATED WITH FEMALE RATS DOSED WITH 100% CLEAN AIR

GROUP I - CONTROL

Rat No.	Week 1 Wt.(g)	Week 2 Wt.(g)	Week 3 Wt.(g)	Week 4 Wt.(g)	Week 5 Wt.(g)	Week 6 Wt.(g)	Week 7 Wt.(g)
1207-1	421.9	422.6	460.6	474.4	479.3	491.6	511.4
1207-4	394.7	395.6	425.5	458.1	451.4	467.3	507.8
1207-7	405.6	410.1	445.8	453.3	460.1	471.5	489.1
1207-10	381.7	397.7	424.3	451.3	452.9	471.9	500.1
1207-13	436.6	454.8	488.8	515.7	521.8	527.4	555.7
1207-16	401.0	416.0	443.9	459.4	472.3	482.6	502.6
1207-19	446.4	459.9	489.5	513.7	514.3	523.3	543.9
1207-22	431.8	450.6	479.1	516.2	537.0	545.2	572.5
1207-25	428.1	436.8	473.9	484.9	498.1	503.6	532.9
1207-28	404.1	405.8	428.1	440.1	453.3	463.7	477.3
Average	415.2	425.2	456.0	476.7	484.1	494.8	519.3

TABLE 4

WEEKLY BODY WEIGHTS FOR MALE RATS WHO MATED WITH FEMALE RATS DOSED WITH A CONCENTRATION OF 10% DIESEL EXHAUST EMISSION

GROUP II - TEST

Rat No.	Week 1 Wt.(g)	Week 2 Wt.(g)	Week 3 Wt.(g)	Week 4 Wt.(g)	Week 5 Wt.(g)	Week 6 Wt.(g)	Week 7 Wt.(g)
1207-31	401.1	410.6	428.5	460.0	465.4	465.7	496.0
1207-34	392.3	407.2	441.6	455.8	459.4	466.6	486.5
1207-37	464.0	476.1	507.1	537.5	564.2	578.5	606.8
1207-40	448.7	463.8	491.8	523.9	537.6	544.0	574.1
1207-43	405.5	431.1	455.0	471.5	484.7	486.1	511.9
1207-46	457.4	466.5	494.6	516.9	539.9	558.2	607.9
1207-49	398.7	412.9	435.5	447.8	454.9	463.6	495.7
1207-52	413.5	412.5	438.2	444.7	456.6	468.1	496.5
1207-55	421.5	408.3	445.1	466.2	470.6	495.2	527.3
1207-58	511.2	513.1	558.7	595.5	619.3	624.4	669.2
Average	431.4	440.2	469.6	492.0	505.3	515.0	547.2

Key

NN	=	Not Necessary
BB	=	Did Not Breed
C	=	C-Sectioned
S	=	Sacrificed
NP	=	Not Pregnant
B	=	Bred

TABLE 5

INDIVIDUAL MATING DATA

Clean Air Inhalation (Group 1)

Dam Number	1st Male Number	Fate	2nd Male Number	Fate	Days Pregnant
1207-2	1207-1	B	NN	C	20
1207-3	1207-1	BB	1207-13	NP	0
1207-5	1207-4	B	NN	C	20
1207-6	1207-4	B	NN	C	20
1207-8	1207-7	B	NN	C	20
1207-9	1207-7	B	NN	C	20
1207-11	1207-10	B	NN	C	20
1207-12	1207-10	BB	1207-7	C	20
1207-14	1207-13	B	NN	C	20
1207-15	1207-13	B	NN	C	20
1207-17*	1207-16	BB	1207-4	S	Approx. 18
1207-18	1207-16	B	NN	C	20
1207-20	1207-19	B	NN	C	20
1207-21	1207-19	B	NN	C	20
1207-23	1207-22	B	NN	C	20
1207-24	1207-22	B	NN	C	20
1207-26	1207-25	B	NN	C	20
1207-27	1207-25	B	NN	NP	0
1207-29	1207-28	B	NN	C	20
1207-30	1207-28	B	NN	C	20

*Not exposed due to assumption that this animal was not successfully bred.

(Continued)

Key		
NN	=	Not Necessary
BB	=	Did Not Breed
C	=	C-Sectioned
S	=	Sacrificed
NP	=	Not Pregnant
B	=	Bred

TABLE 5 (Continued)

INDIVIDUAL MATING DATA

Diesel Exhaust Inhalation (Group 2)

Dam Number	1st Male Number	Fate	2nd Male Number	Fate	Days Pregnant
1207-32	1207-31	B	NN	C	20
1207-33	1207-31	B	NN	C	20
1207-35	1207-34	B	NN	C	20
1207-36	1207-34	B	NN	C	20
1207-38	1207-37	B	NN	C	20
1207-39	1207-37	B	NN	C	20
1207-41	1207-40	B	NN	C	20
1207-42	1207-40	B	NN	C	20
1207-44	1207-43	B	NN	C	20
1207-45	1207-43	B	NN	C	20
1207-47	1207-46	B	NN	C	20
1207-48	1207-46	B	NN	C	20
1207-50	1207-49	BB	1207-31	NP	0
1207-51	1207-49	B	NN	C	20
1207-53	1207-52	B	NN	C	20
1207-54	1207-52	B	NN	C	20
1207-56	1207-55	B	NN	C	20
1207-57	1207-55	B	NN	C	20
1207-59	1207-58	B	NN	C	20
1207-60	1207-58	B	NN	C	20

LAPAROTOMY DATA

Diesel exhaust emissions produced no malformation or other teratogenic effects in the unborn rat fetuses.

All rat pups were examined at the time of cesarean section and no gross abnormalities were noted. The bruised areas recorded were due to manipulation of the pups with forceps (Table 6).

The total number of fetuses, number of live and dead fetuses, number of resorptions, number of implantation sites, corpora lutea and distribution of fetuses are presented in Tables 9 and 10. None of these parameters were altered following exposure to diesel exhaust emissions.

The test material produced no effect on individual pups or total litter weight nor sex distribution (Tables 7 and 8).

Soft tissue examination of fetuses is presented in Table 11 and no malformations directly related to diesel exhaust emission exposure were observed. All abnormalities observed were considered to be slight modifications from normal and were within the limits of normal variation.

No skeletal malformations related to the test material were noted (Tables 12 and 13). Skeletal examination of the fetuses revealed some minor spontaneous malformations in both the control and test groups but these changes were not related to the exposure to the diesel exhaust emission.

No signs of maternal toxicity were observed during the gross necropsy of the dams but the lungs of diesel exhaust exposed animals were observed to be a pinkish-brown color as compared to the pink color in control rats. It was assumed that this change is due to the presence of test material in the lungs or at least due to a response to the presence of the diesel exhaust emissions (Table 15).

FETAL VISCERAL DATA

Table 11 presents soft tissue examinations of the fetuses. The only fetuses listed in this table are the anomalies or abnormalities.

No significant or conclusive data can be made relative to the test material. All fetuses not listed were normal.

FETAL SKELETAL DATA

Tables 12 and 13 present the mean values of the ossified elements for the term fetuses at the time of the skeletal examinations.

Table 14 presents the skeletal examination of the fetuses which show anomalies or abnormalities. All other fetuses were observed to be normal.

The results from these tables have not drawn any conclusive data that can be made relative to the test material.

GROSS NECROPSIES

Table 15 presents the gross necropsy findings from the dams in each group. The only significant observation made for Group 2, the diesel fuel group, was the distinct pink-brown appearance of the lungs.

TABLE 6

GROSS FETAL EXAMINATION AT TIME OF LAPAROTOMY

Dam No.	Fetus No.	Exposure Level	Sex	Gross Observation
1207-2	4	Clean Air	M/	Left rear leg had 2 mm red area, also a dark subcutaneous spot was present on right side midway between shoulder and ear.
1207-3*				
1207-5		Clean Air		All fetuses appeared normal.
1207-6	12	Clean Air	F/	Intradermal blotchy area .5 cm x .5 cm on right side of skull behind ear.
1207-8	14&15	Clean Air	F/F	Fetuses were in the same placenta and they appeared normal.
1207-9		Clean Air		All fetuses appeared normal.
1207-11		Clean Air		All fetuses appeared normal.
1207-12	2	Clean Air	M/	Subcutaneous bruised area under chin.
	12	Clean Air	F/	Subcutaneous 2 mm bruised area along thoracic vertebrae.
1207-14		Clean Air		All fetuses appeared normal.
1207-15		Clean Air		All fetuses appeared normal.
1207-17[1]				
1207-18		Clean Air		All fetuses appeared normal

*Animal was not pregnant

[1]Rat was not exposed due to miscalculation of pregnancy.

(continued)

TABLE 6 (Continued)

Dam No.	Fetus No	Exposure Level	Sex	Gross Observations
1207-20	3	Clean Air	M/	Intradermal dark red area on upper portion of back.
1207-21	4	Clean Air	M/	Medial side of left hind leg and areas between toes were bruised.
	6	Clean Air	F/	Right hind foot bruised on heel area.
1207-23	6	Clean Air	M/	Dorsal region of neck has three 1 mm red areas.
	8	Clean Air	M/	A 2 mm red area located on right side of head between eye and ear.
	10	Clean Air	F/	A 2 mm red area located on right side of head between eye and ear.
1207-24	10	Clean Air	M/	Intradermal area 4 mm x 4 mm located on right side of head.
1207-26		Clean Air		All fetuses appeared normal.
1207-27*				
1207-29	2	Clean Air	M/	Red area 2 mm above ear on right side of head.
	8	Clean Air	M/	Red area 1 mm located directly below nose.
	10	Clean Air	M/	Red area 2 mm above right eye.
	12	Clean Air	M/	Red area 4 mm midline of snout also bottom of left front foot.
	13	Clean Air	F/	Red area 2 mm above right ear.
	15	Clean Air	F/	Medial side of rear legs are reddened.

*Animal was not pregnant.

(continued)

TABLE 6 (Continued)

Dam No.	Fetus No	Exposure Level	Sex	Gross Observations
1207-30	3	Clean Air	F/	Intradermal scattered red areas on left side of head.
1207-30	7	Clean Air	F/	Fetus born dead, very small in size, fluid subcutaneous over entire body and two 2 mm intradermal red areas located on back of head.
1207-32		Diesel Exhaust		All fetuses appeared normal.
1207-33	10	Diesel Exhaust	M/	Bruised area on right side of head.
	13	Diesel Exhaust	M/	1 mm red spot midway on tail.
1207-35		Diesel Exhaust		All fetuses appeared normal.
1207-36	12	Diesel Exhaust	M/	Subcutaneous 1.5 mm red area at dorsal midline.
1207-38		Diesel Exhaust		All fetuses appeared normal.
1207-39	14	Diesel Exhaust	M/	Forcep bruises on mouth.
	15	Diesel Exhaust	F/	Forcep bruises on mouth.
1207-41		Diesel Exhaust		All fetuses appeared normal.
1207-42	17	Diesel Exhaust	F/	Intradermal blotchy area 9 mm in diameter on right side of head.
1207-44		Diesel Exhaust		All fetuses appeared normal.
1207-45	12	Diesel Exhaust	M/	Bruised area on right side of head.
1207-47	5	Diesel Exhaust	F/	Bruised areas on right side of head, thought to be caused from handling.
	6	Diesel Exhaust	F/	Bruised area below right ear.
	11	Diesel Exhaust	F/	Bruised area on top of nose.
1207-48		Diesel Exhaust		All fetuses appeared normal.

(continued)

TABLE 6 (Continued)

Dam No.	Fetus No	Exposure Level	Sex	Gross Observations
1207-50*				
1207-51	3	Diesel Exhaust	M/	Fetus appeared to be bloated subcutaneously, also there were subcutaneous bruises at neck, head and lower back region.
	16	Diesel Exhaust	M/	Intradermal bruise on top of head.
1207-53		Diesel Exhaust		All fetuses appeared normal.
1207-54		Diesel Exhaust		All fetuses appeared normal.
1207-56	7	Diesel Exhaust	M/	Intradermal 1 mm dark red area at neck and mid-back and fissures of cranium.
	8	Diesel Exhaust	M/	Intradermal 1 mm dark red area at lateral region of left leg.
	9	Diesel Exhaust	F/	Intradermal 3 mm x 1 mm dark red area at cranium.
1207-57	5	Diesel Exhaust	M/	Bruised area on left side of snout.
	16	Diesel Exhaust	M/	Medial side of right hind femur had a diffused red area, also two red areas 1 mm each on upper region of back.
1207-59	10	Diesel Exhaust	F/	Intradermal red area at end of tail.
	15	Diesel Exhaust	F/	Skin on back was cut due to handling.
1207-60	1	Diesel Exhaust	M/	4 mm cut on right hip was due to handling.
	4	Diesel Exhaust	F/	Intradermal 2 mm red area on right side of head.

*Animal was not pregnant.

TABLE 7

FETAL DATA FOR DAMS WHICH WERE EXPOSED TO CLEAN AIR (GROUP I CONTROL)

SEX DISTRIBUTION, AVERAGE FETAL WEIGHT (g), GROUP FETAL WEIGHT, INDIVIDUAL FETUS WEIGHT (g), FETUS POSITION IN UTERINE HORN[1]

Dam No.	Sex Distribution Males	Females	Total Number of Fetuses	Average Fetal Wt. (g)	Group Fetal Wt.(g)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1207-2	9	6	15	3.7	56.2	3.4	4.0	4.1	3.9	3.7	4.0	4.0	4.0/	3.7	3.6	3.4	3.5	3.5	3.6	3.8		
1207-3[2]																						
1207-5	2	4	6	3.8	22.5	3.8	3.8	3.6	*	4.0	3.5	3.8/										
1207-6	9	6	15	3.7	54.8	3.6	3.6	3.7	3.9	3.7/	3.3	3.1	3.8	4.1	3.8	*	3.3	4.2	3.6	3.5	3.6	
1207-8	4	11	15	3.8	56.7	3.7	3.6	*	4.2	3.7	4.1	3.9/	4.0	3.8	3.7	3.8	3.7	3.9	3.4	3.5	3.7	
1207-9	5	5	10	3.8	38.2	*	*	*	2.7/	3.9	3.7	4.2	3.6	4.2	3.8	4.3	3.9	3.9				
1207-11	7	6	13	4.1	53.7	4.1	4.3	4.5	*	3.8	*	4.4	4.1	4.7/	4.2	4.4	3.7	3.8	4.1	3.6		
1207-12	7	5	12	3.7	44.0	3.6	3.6	3.8	3.8	3.7	3.4	3.5	3.9/	3.5	3.6	*	3.7	4.0				
1207-14	9	5	14	3.6	50.4	3.6	3.4	3.7	3.5	3.5/	3.8	*	3.4	3.6	3.8	3.7	3.8	*	3.6	*	3.8	3.2
1207-15	6	5	11	3.9	42.8	3.8	4.1	4.1	3.8	3.6	3.8	3.9/	3.6	3.8	4.0	4.3						
1207-17[3]																						
1207-18	7	7	14	4.0	55.3	3.9	3.7	3.8	3.9	4.1	4.1	4.2/	4.3	*	3.8	4.4	4.0	3.8	3.7	3.6		
1207-20	9	5	14	3.7	51.1	3.5	3.4	3.4	3.7	3.8	3.8	3.9	3.6/	3.6	3.5	3.6	3.8	3.7	3.8			
1207-21	7	7	14	3.5	49.2	3.6	3.7	4.0	3.5	2.9/	3.4	3.2	3.7	3.6	3.4	3.8	3.5	3.5	3.4			
1207-23	9	4	13	4.1	52.8	*	4.3	4.1	4.3	*	3.8/	4.1	3.9	3.9	4.1	3.9	4.2	3.9	4.2	4.1		
1207-24	7	6	13	3.9	50.5	3.9	4.3	*	3.5	4.0	3.8	4.0	3.8/	3.9	3.7	3.8	3.9	3.9	4.0			
1207-26	6	7	13	3.4	44.3	3.3	3.4	3.6	3.2	3.3/	3.6	3.1	3.3	3.3	3.3	3.5	3.9	3.5				
1207-27[2]																						
1207-29	10	6	16	3.9	61.8	3.7	4.1	3.5	3.9	3.8	4.1	3.3	4.4/	3.9	4.0	3.4	4.1	3.7	4.1	3.8	4.0	
1207-30	4	6	10	3.4	34.1	3.4	3.7	3.6	*	*/	3.4	1.7	4.2	3.8	3.2	4.1	*	3.0	*			

1 Positions are counted from the left Fallopian Tube to the right Fallopian Tube.
2 Not pregnant
3 Female was sacrificed due to miscalculation of pregnancy and non-exposure, only number of fetuses and corpora lutea were counted. Weight, sex, and position of fetus were not recorded.
* Early resorption
/ Denotes position of cervix

TABLE 8

FETAL DATA FOR DAMS WHICH WERE EXPOSED TO DIESEL EXHAUST INHALATION (GROUP II - TEST)

SEX DISTRIBUTION, AVERAGE FETAL WEIGHT (g), GROUP FETAL WEIGHT, INDIVIDUAL FETUS WEIGHT (g), FETUS POSITION IN UTERINE HORN[1]

Dam No.	Sex Distribution Males	Females	Total Number of Fetuses	Average Fetal Wt. (g)	Group Fetal Wt.(g)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1207-32	5	5	10	3.5	34.5	3.0	*	3.8	*	*	3.7	3.2	4.0/	3.6	*	3.3	3.3	3.5	3.1				
1207-33	6	7	13	3.5	45.5	3.5	3.4	3.4	3.5	3.5/	3.6	3.9	3.6	3.2	3.6	3.3	3.3	3.7					
1207-35	4	8	12	3.7	43.9	3.9	3.6	4.2	3.5	3.8/	*	3.3	3.6	3.7	4.0	3.5	3.3	3.5					
1207-36	8	8	16	3.4	55.1	3.4	3.3	3.1	3.8	3.4	3.3	3.5/	3.7	3.6	3.4	3.5	3.9	2.6	3.6	3.7	3.3		
1207-38	8	9	17	4.2	71.3	4.4	4.2	3.9	4.3	3.8	4.3	3.5/	4.4	4.0	4.0	4.5	4.3	4.4	4.5	4.5	3.9	4.4	*
1207-39	7	8	15	3.6	54.5	3.3	*	3.7	3.7	3.7	3.7/	3.4	3.2	3.6	3.8	3.7	3.7	3.8	3.8	3.7	3.7		
1207-41	5	8	13	3.6	47.1	3.9	3.8	3.7	3.3	3.5	3.6/	3.3	3.7	3.8	3.7	3.3	3.8	3.7					
1207-42	9	6	15	3.6	53.5	3.2	*	3.5	3.6	*	4.0/	3.4	3.3	3.4	3.7	3.7	3.6	3.8	3.9	3.6	3.8	3.0	
1207-44	6	7	13	3.9	50.1	4.2	4.1	3.9	4.0	3.5	4.0/	3.7	3.7	3.8	3.8	3.8	4.0	3.6					
1207-45	9	5	14	3.9	54.1	4.0	4.1	4.2	3.8/	3.9	3.5	3.3	4.0	4.1	3.9	4.1	3.7	3.9	3.6				
1207-47	4	8	12	3.5	41.6	3.6	3.4	3.3	2.6	3.2	3.5	3.7/	3.7	3.6	3.5	3.7	3.8						
1207-48	6	6	12	3.5	41.8	3.4	3.6	3.6	3.5	3.4	3.4	4.0	*/	*	3.4	3.3	3.6	3.3	3.3				
1207-50[2]																							
1207-51	11	6	17	3.4	57.9	4.0	3.3	4.0	3.3	3.2	3.2	3.0	4.0	3.3/	3.6	3.0	*	3.1	3.6	3.8	3.7	2.5	3.3
1207-53	7	6	13	3.9	50.4	3.7	3.8	4.0	3.7	4.2	4.0/	3.9	3.7	3.6	3.9	3.9	4.1	3.9					
1207-54	8	9	17	3.7	63.7	3.6	3.9	3.8	3.7	3.5	3.4	3.8	3.7/	3.9	3.9	3.5	3.6	4.1	3.7	3.9	3.8	3.9	
1207-56	8	8	16	3.6	59.3	3.2	3.7	3.7	3.9	3.9	3.5	3.6	3.7/	3.6	4.1	*	3.9	3.4	4.0	3.9	3.6	3.6	
1207-57	5	11	16	3.5	56.6	3.6	3.6	3.4	3.6	3.7	3.8/	3.9	3.5	3.4	3.4	3.5	3.3	3.4	3.6	3.8	3.1		
1207-59	7	8	15	3.3	49.0	3.1	3.3	3.3	3.7	3.2	3.4	3.0	3.1	2.7/	2.9	3.7	3.5	3.7	3.4	3.0			
1207-60	7	8	15	3.8	57.2	3.9	3.9	4.0	3.7	3.8	4.2/	3.5	3.5	4.0	3.8	3.9	3.9	3.7	3.8	3.6			

1 Positions are counted from the left Fallopian Tube to the right Fallopian Tube
2 Not pregnant
* Early resorption
/ Denotes position of cervix

TABLE 9

FETAL DATA FOR DAMS WHICH WERE EXPOSED TO CLEAN AIR (GROUP I - CONTROL)

NUMBER OF FETUSES VIABLE AND DEAD, EARLY RESORPTIONS,
IMPLANTATION SITES, AND CORPORA LUTEA

	Viable Fetuses			Dead Fetuses			Early Resorption			Implantation Sites			Corpora Lutea		
Dam No.	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total
1207-2	8	7	15	0	0	0	0	0	0	8	7	15	8	7	15
1207-3[1]															
1207-5	6	0	6	0	0	0	1	0	1	7	0	7	7	6	13
1207-6	5	10	15	0	0	0	0	1	1	5	11	16	5	11	16
1207-8	6	9	15	0	0	0	1	0	1	7	9	16	8	9	17
1207-9	1	9	10	0	0	0	3	0	3	4	9	13	7	9	16
1207-11	7	6	13	0	0	0	2	0	2	9	6	15	9	6	15
1207-12	8	4	12	0	0	0	0	1	1	8	5	13	8	9	17
1207-14	5	9	14	0	0	0	0	3	3	5	12	17	9	14	23
1207-15	7	4	11	0	0	0	0	0	0	7	4	11	7	4	11
1207-17[2]															
1207-18	7	7	14	0	0	0	0	1	1	7	8	15	7	8	15
1207-20	8	6	14	0	0	0	0	0	0	8	6	14	10	7	17
1207-21	5	9	14	0	0	0	0	0	0	5	9	14	7	12	19
1207-23	4	9	13	0	0	0	2	0	2	6	9	15	7	9	16
1207-24	7	6	13	0	0	0	1	0	1	8	6	14	8	6	14
1207-26	5	8	13	0	0	0	0	0	0	5	8	13	5	8	13
1207-27[1]															
1207-29	8	8	16	0	0	0	0	0	0	8	8	16	8	9	17
1207-30	3	6	9	0	1	1	2	2	4	5	9	14	5	9	14

1 Not pregnant
2 Female was sacrificed due to miscalculation of pregnancy and non-exposure.

TABLE 10

FETAL DATA FOR DAMS WHICH WERE EXPOSED TO DIESEL EXHAUST INHALATION (GROUP II - TEST)

NUMBER OF FETUSES VIABLE AND DEAD, EARLY RESORPTIONS,
IMPLANTATION SITES, AND CORPORA LUTEA

	Viable Fetuses			Dead Fetuses			Early Resorption			Implantation Sites			Corpora Lutea		
Dam No.	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total	Left Horn	Right Horn	Total
1207-32	5	5	10	0	0	0	3	1	4	8	6	14	8	7	15
1207-33	5	8	13	0	0	0	0	0	0	5	8	13	7	10	17
1207-35	5	7	12	0	0	0	0	1	1	5	8	13	5	8	13
1207-36	7	9	16	0	0	0	0	0	0	7	9	16	8	10	18
1207-38	7	10	17	0	0	0	0	1	1	7	11	18	7	11	18
1207-39	5	10	15	0	0	0	1	0	1	6	10	16	9	10	19
1207-41	6	7	13	0	0	0	0	0	0	6	7	13	6	7	13
1207-42	4	11	15	0	0	0	2	0	2	6	11	17	7	11	18
1207-44	6	7	13	0	0	0	0	0	0	6	7	13	6	8	14
1207-45	4	10	14	0	0	0	0	0	0	4	10	14	4	12	16
1207-47	7	5	12	0	0	0	0	0	0	7	5	12	12	7	19
1207-48	7	5	12	0	0	0	1	1	2	8	6	14	9	8	17
1207-50[1]															
1207-51	9	8	17	0	0	0	0	1	1	9	9	18	11	11	22
1207-53	6	7	13	0	0	0	0	0	0	6	7	13	6	7	13
1207-54	8	9	17	0	0	0	0	0	0	8	9	17	8	9	17
1207-56	8	8	16	0	0	0	0	1	1	8	9	17	10	8	18
1207-57	6	10	16	0	0	0	0	0	0	6	10	16	7	10	17
1207-59	9	6	15	0	0	0	0	0	0	9	6	15	9	6	15
1207-60	6	9	15	0	0	0	0	0	0	6	9	15	7	9	16

1 Not pregnant

TABLE 11

SOFT TISSUE EXAMINATION OF THE FETUSES

Dam No.	Fetus No.	Exposure Level	Sex	Abnormality
1207-9	9	Clean Air	M/	Kidneys show slight nephredema.
1207-15	3	Clean Air	M/	Kidneys show slight nephredema.
	6	Clean Air	M/	Left kidney showed slight nephredema and left ureter was dilated.
1207-20	9	Clean Air	M/	Right testicle higher than left.
1207-26	9	Clean Air	M/	Right testicle retained.
	12	Clean Air	M/	Right testicle sitting on rectum and leaning to the left.
1207-35	3	Diesel Exhaust	M/	Left testicle higher than right.
	7	Diesel Exhaust	F/	Left uterine horn shorter in length.
1207-44	3	Diesel Exhaust	F/	Right kidney had nephredema.
	6	Diesel Exhaust	F/	Right kidney had nephredema.
	9	Diesel Exhaust	M/	Ureters were dilated.
1207-45	3	Diesel Exhaust	M/	Kidneys showed nephredema.
1207-48	3	Diesel Exhaust	M/	Kidneys showed nephredema and ureters were anteriorly dilated.
	11	Diesel Exhaust	F/	Right kidney showed nephredema and right ureter anteriorly dilated.
1207-60	6	Diesel Exhaust	M/	Right kidney showed nephredema.
	9	Diesel Exhaust	M/	Left kidney showed nephredema and left ureter anteriorly dilated. Left testicle was cryptorchid.

TABLE 12
SKELETAL EXAMINATION OF TERM FETUSES, MEAN NUMBER OF OSSIFIED ELEMENTS - CLEAN AIR INHALATION (GROUP I)

Dam No:	2		5		6		8		9		11		12		14	
Cervicle	6		6		6		6		6		6		6		6	
Thoracic	13		13		13		13		13		13		13		13	
Lumbar	6		6		6		6		6		6		6		6	
Sacral	6		6		6		6		6		6		6		6	
Tail	2.6		2		2.6		2.8		2.4		2.6		2		1.5	
Sternum	5.7		5.8		5.3		5.8		5.7		6		5.8		4.8	
Ribs	13		13		13		13		13		13		13		13	
Foredigits	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	3.8	3.9	3.3	3.3	3.8	3.8	3.7	3.7	3	3	3.4	3.4	3	3	2.9	2.8
Proximal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Middle 1.) 2.) - 3.)	2.6	2.6	2	2	3	3	2	2	3	3	2.1	2.1	3	3	2.3	2.3
Distal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hindigits	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	4[1]	4[2]	4	3.3	4	4	4	4	3.9	3.9	4	4[3]	4	4	4	4
Proximal	1[1]	1[2]	1	1	1	1	1	1	1	1	1	1[3]	1	1	1	1
Middle 1.) 2.) - 3.)	3[1]	3[2]	3	3	3.2	3.2	3	3	3	3	3	3[3]	3	3	3	3
Distal	1[1]	1[2]	1	1	1	1	1	1	1	1	1	1[3]	1	1	1	1

1 One Fetus' left hind foot missing due to handling, therefore, these mean values are exclusive of this foot.
2 Two Fetuses are missing right hind foot, therefore, these mean values are exclusive of these two feet.
3 One Fetus' right hind foot was detached and difficult to observe; these mean values are exclusive of this fetus' foot.

(Continued)

TABLE 12 (Continued)

Dam No:	15		18		20		21		23		24		26		29*		30	
Cervicle	6		6		6		6		6		6		6		6		6	
Thoracic	13		13		13		13		13		13		13		13		12.7	
Lumbar	6		6		6		6		6		6		6		6		6	
Sacral	6		6		6		6		6		6		6		6		5.6	
Tail	2.1		2		2.5		2.4		2		3		2.8		2.8		1.7	
Sternum	5.9		5.6		6		5.5		5.9		6		5.9		5.9		4.6	
Ribs	13		13		13		13		13		13		13		13		12.7	
Foredigits	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	3.3	3.3	3	3	4	4	3.8	3.8	3.8	3.8	4	4	4	4	3.5	3.5	2.7	2.9
Proximal 1.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.9	.9
Middle 2.) - 3.)	3	3	3	3	2	2	3	3	2.8	2.8	3	3	2	2	3	3	2.6	2.6
Distal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.9	.9
Hindigits	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4[1]	4[4]	3.4	3.4
Proximal 1.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1[1]	1[4]	.9	.9
Middle 2.) - 3.)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3[1]	3[4]	2.6	2.6
Distal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1[1]	1[4]	.9	.9

1 One Fetus' left hind foot missing due to handling, therefore, these mean values are exclusive of this foot.
4 One Fetus' right hind foot was missing due to over masceration, therefore, mean value is exclusive of this foot.
* One whole fetus was not included in mean values due to over masceration.

TABLE 13

SKELETAL EXAMINATION OF TERM FETUSES, MEAN NUMBER OF OSSIFIED ELEMENTS - DIESEL EXHAUST INHALATION (GROUP II)

Dam No.:	32		33		35		36		38		39	
Cervicle	6		6		6		6		6		6	
Thoracic	13		13		13		13		13		13	
Lumbar	6		6		6		6		6		6	
Sacral	6		6		6		6		6		6	
Tail	1.9		2		3.4		2.5		3.2		2.5	
Sternum	5.6		5.7		6		5.1		5.5		5.7	
Ribs	13		13		13		13		13		13	
Foredigits	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	3.3	3.3	3.3	3.3	4	4	3.5	3.5	3.8	3.8	3.7	3.8
Proximal	1	1	1	1	1	1	1	1	1	1	1	1
Middle 1.) 2.) 3.)	2	2	2	2	2	2	3	3	2	2	2.8	2.8
Distal	1	1	1	1	1	1	1	1	1	1	1	1
Hindigits	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	4	4	4	4	4	4	4	4	4	4	4	4
Proximal	1	1	1	1	1	1	1	1	1	1	1	1
Middle 1.) 2.) 3.)	3	3	3	3	3	3	3	3	3	3	2.9	2.9
Distal	1	1	1	1	1	1	1	1	1	1	1	1

(Continued)

TABLE 13 (Continued)
SKELETAL EXAMINATION OF TERM FETUSES, MEAN NUMBER OF OSSIFIED ELEMENTS - DIESEL EXHAUST INHALATION (GROUP II)

Dam No.:	41		42		44		45		47		48	
Cervicle	6		6		6		6		6		6	
Thoracic	13		13		13		13		13		13	
Lumbar	6		6		6		6		6		6	
Sacral	6		6		6		6		6		6	
Tail	2.4		2		2.6		2.2		1.4		2.1	
Sternum	5.1		4.7		5.3		5.4		5.3		5.5	
Ribs	13		13		13		12.9		13		13	
Foredigits	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	3.6	3.7	3	3[1]	3.8	3.8	3.6	3.6	3	3	3.5	3.6
Proximal 1.)	1	1	1	1[1]	1	1	1	1	1	1	1	1
Middle 2.) - 3.)	2	2	2	2[1]	3	3	3	3	3	3	3	3
Distal	1	1	1	1[1]	1	1	1	1	1	1	1	1
Hindigits	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	4	4	4	4	4	4	4	4[2]	3.9	3.9	4	4
Proximal 1.)	.9	.9	1	1	1	1	1	1[2]	1	1	1	1
Middle 2.) - 3.)	2.7	2.7	3	3	3	3	3	3[2]	3	3	3	3
Distal	1	1	3	3	1	1	1	1[2]	1	1	1	1

1 One Fetus' right hand was missing due to over masceration, therefore, these mean values are exclusive of this hand.
2 One Fetus' hind foot was missing due to handling, therefore, these mean values are exclusive of this foot.

TABLE 13 (Continued)
SKELETAL EXAMINATION OF TERM FETUSES, MEAN NUMBER OF OSSIFIED ELEMENTS - DIESEL EXHAUST INHALATION (GROUP II)

Dam No.:	51		53		54		56		57		59		60	
Cervicle	6		6		6[3]		6		6		6		6	
Thoracic	13		13		13		13		13		13		13	
Lumbar	6		6		6		6		6		6		6	
Sacral	6		6		6		5.9		6		6		6	
Tail	2.1		3		2.3		2.6		1.6		1.6		1.7	
Sternum	5.3		5.9		5.3		6		5.1		5		5.2	
Ribs	13		13		13		13		13		13		13	
Foredigits	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Metacarpals	3.2	3.1	3.8	3.8	3.2	3.3	3.7	3.7	3	3	3	3	3.2	3.2
Proximal	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Middle (1.) (2.) (3.)	3	3	2.2	2.3	3	3	2.6	2.6	3	3	2.3	2.3	3	3
Distal	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hindigits	L	R	L	R	L	R	L	R	L	R	L[2]	R	L	R
Metacarpals	4	4	4	4	3.8	3.9	4	4	4	4	4[2]	4	4	4
Proximal	1	1	1	1	1	1	1	1	1	1	1[2]	1	1	1
Middle (1.) (2.) (3.)	3	3	3	3	3	3	3	3	3	3	2.4[2]	2.7	3	3
Distal	1	1	1	1	1	1	1	1	1	1	1[2]	1	1	1

2 One Fetus' hind foot was missing due to handling, therefore, these mean values are exclusive of this foot.
3 One Fetus' cervicle area was beyond recognition, therefore, this mean value was exclusive of this particular Fetus' cervical bones.

TABLE 14

SKELETAL EXAMINATION OF THE FETUSES

Dam No.	Fetus No.	Exposure Level	Sex	Abnormality
1207-6	6	Clean Air	F/	Sternum was not aligned. Sternebrae 5 and 6 appeared to be shifted to the left.
1207-8	15	Clean Air	F/	All five upper sternebrae appear to be split and not aligned. 6th sternebrae appears to be normal.
1207-14	11	Clean Air	M/	Left lumbar 1 appeared to have an extension.
	12	Clean Air	M/	Second sternebrae was not completely calcified.
1207-18	15	Clean Air	F/	Parietal bone in skull was difficient and parietal frontal bones were deficient.
1207-29	2	Clean Air	M/	Sternebrae 3, 4, 5, and 6 were not aligned.
	7	Clean Air	M/	Sternebrae 2 and 5 were not completely calcified.
1207-30	7	Clean Air	F/	Fetus was abnormally small and immature, bone structure was not complete.
	13	Clean Air	M/	Intraparietal bone of skull was not completely calcified and the supraoccipal was not symmetrical. Sternebrae 2 was not completely calcified.
1207-36	10	Diesel Exhaust	F/	Supraoccipital of skull was not completely calcified and was nonsymmetrical.

(continued)

TABLE 14 (Continued)

Dam No.	Fetus No	Exposure Level	Sex	Abnormality
1207-36	13	Diesel Exhaust	M/	Sternebrae 1, 3, 5 and 6 were not present.
1207-38	10	Diesel Exhaust	F/	Parietal bones appeared to be slightly separated.
1207-42	9	Diesel Exhaust	M/	Parietal bones appeared to be slightly separated and all cranial bones appeared irregular and lack symmetry.
	10	Diesel Exhaust	M/	Parietal bones appeared to be slightly separated and all cranial bones appeared irregular and lacked symmetry.
1207-51	17	Diesel Exhaust	M/	Second sternebrae was not completely calcified.
1207-54	11	Diesel Exhaust	F/	Right and left femur at distal end was darker in color.
	13	Diesel Exhaust	M/	Left humerus at distal end was darker in color.
	16	Diesel Exhaust	F/	Left femur at distal end was darker in color.
1207-54	10	Diesel Exhaust	M/	Sternebrae 3 was split.
	16	Diesel Exhaust	F/	Sternebrae was difficult to determine, some appeared to be split.
1207-56	5	Diesel Exhaust	M/	Sternum appeared to have 7 sternebrae, however, the first one may have been split.

TABLE 15

GROSS NECROPSY RESULTS FOR 20-DAY LAPAROTOMY FOR FEMALE RATS

Dam No.	Group No.	Exposure Level	Gross Necropsy Findings
1207-15	1	Clean Air	Kidneys appeared mottled. No other remarkable gross pathology was noted.
1207-23	1	Clean Air	Lungs were reddened and diffused. Slightly brown. No other remarkable gross pathology was noted.
	1	Clean Air	No remarkable gross pathology was noted in any female rat from this group.
1207-32	2	Diesel Exhaust	Lungs were found to be pinkish-brown in color. No other remarkable gross pathology was noted.
1207-33	2	Diesel Exhaust	No remarkable gross pathology was noted.
1207-35	2	Diesel Exhaust	Lungs were found to be pinkish-brown in color. No other remarkable gross pathology was noted.
1207-36	2	Diesel Exhaust	Lungs were found to be pinkish-brown in color. No other remarkable gross pathology was noted.
1207-38	2	Diesel Exhaust	Lungs were found to be pinkish-brown in color. No other remarkable gross pathology was noted.
1207-39	2	Diesel Exhaust	Lungs were pinkish-brown in color. No other remarkable gross pathology was noted.
1207-41	2	Diesel Exhaust	Lungs were pinkish-brown in color. No other remarkable gross pathology was noted.
1207-42	2	Diesel Exhaust	Lungs were mottled dark red on all lobes. No other remarkable gross pathology was noted.
1207-44	2	Diesel Exhaust	No remarkable gross pathology was noted.

(continued)

TABLE 15 (Continued)

Dam No.	Group No.	Exposure Level	Gross Necropsy Findings
1207-45	2	Diesel Exhaust	Lungs appeared to be brown and red in color. No other remarkable gross pathology was noted.
1207-47	2	Diesel Exhaust	No remarkable gross pathology was noted.
1207-48	2	Diesel Exhaust	Lungs were mottled dark red except for edges of all lobes which were pink. No other remarkable gross pathology was noted.
1207-50	2	Diesel Exhaust	Lungs were pinkish-brown in color. No other remarkable gross pathology was noted.
1207-51	2	Diesel Exhaust	Lungs appeared brownish-red in color. No other remarkable gross pathology was noted.
1207-53	2	Diesel Exhaust	Lungs were mottled red in color. No other remarkable gross pathology was noted.
1207-54	2	Diesel Exhaust	Lungs appeared to be pinkish-brown in color. No other remarkable gross pathology was noted.
1207-56	2	Diesel Exhaust	Lungs appeared brown; right and left diaphragmatic lobes of the lungs were red at edges. No other remarkable gross pathology was noted.
1207-57	2	Diesel Exhaust	Lungs appeared pink with large areas of red on every lobe. No other remarkable gross pathology was noted.
1207-59	2	Diesel Exhaust	Lungs appeared pinkish-brown in color. No other remarkable gross pathology was noted.
1207-60	2	Diesel Exhaust	Lungs appeared pinkish-brown in color. No other remarkable gross pathology was noted.